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Notes on Maize.

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XI.

My own experiments on the pollination of corn have been from the planting of many varieties and seed-selections in juxtaposition, and then studying the crop produced. Where commercial seed or named samples were used, and the crop critically examined for off kernels, the result was:

Zea everta. 1883, one variety, all pop kernels; 1884, five varieties, all pop kernels; 1885, three varieties, all pop kernels.

Zea indurata. 1883, ten varieties, all flint kernels; 1884, nineteen varieties, all flint kernels; 1885, three varieties, all flint kernels.

Zea indentata. 1883, twelve varieties, all dent kernels; 1884, eleven varieties, all dent kernels; 1885, two varieties, and one had some flint kernels.

Zea amylacea. 1883, one variety, and some flint kernels; 1884, nine varieties, and all soft kernels; 1885, four varieties, and one had some flint kernels.

Zea saccharata. 1883, twenty-seven varieties, and of these twenty-four had some flint kernels; 1884, thirty-five varieties, and of these five had some dent kernels, and twenty-nine had some flint kernels; 1885, ten varieties, and of these two had some dent

* Continued from Bulletin, Aug. 1894, p. 343.

kernels, five had some flint, one had some flint and soft, and one had some flint, dent and soft kernels.

We hence would conclude that current fertilization, or the effect of the pollen of the same year, is not facile between the species except in the case of the sweets. Professor Kellerman, of the Kansas Experiment Station, in the Report for 1888, p. 331, gives the result of artificial crossings, as below:

Pop × dent. 1 trial. No evidence of a cross.
Flint × pop. 1 trial. " "
Flint × flint. 3 trials. " "
Flint × dent. 7 trials. " "
Flint × sweet. 1 trial. " "
Dent × pop. 2 trials. No certain evidence of a cross.
Dent × flint. 4 trials. No evidence of a cross; 1 trial, slight evidence of a cross.
Dent × dent. 6 trials. No clear evidence of a cross.
Dent × sweet. 2 trials. No evidence of a cross.
Sweet × pop. 3 trials. Clear evidence of a cross.
Sweet × flint. 1 trial. Doubtful evidence of a cross; 2 trials, clear evidence of a cross.
Sweet × dent. 1 trial. No evidence of a cross; 2 trials, apparent evidence of a cross.
Sweet × sweet. 3 trials. No evidence of a cross.

Thus the evidence collected by two different methods give results in unison; as shown more clearly below:

Female parent.	Sturtevant.	Kellerman.
Zea everta.	No evidence in favor.	No evidence in favor.
indurata.	do	do
indentata.	Slight evidence in favor.	Slight evidence in favor.
amylacea.	do	—
saccharata.	Much evidence in favor.	Much evidence in favor.

That corn will self-fertilize seems evident from the always finding of kernels, and occasionally well-filled ears, on plants from single kernels that either accidentally or purposely have grown remote from other plantings of their kind. This positive evidence, perhaps not conclusive on account of the facility by which pollen is moved by the wind, seems to me to outweigh the negative results reported by observers for definite trials.

That corn cross-fertilizes readily is evident to the most careless observer. Even the Indians of New England had noticed the fact, but had attributed the cause to the roots reaching to and communicating with each other. The result of inter-crossings, as expressed in the ears, and given below from the data obtained from the use of seed grown under conditions that almost compelled interchange of pollen, and some of the seed taken from ears of other varieties or species than their own.

Zea everta. 1883, nineteen plantings, of these seven produced pop and flint ears, twelve produced all pop ears; 1884, eight plantings, of these one produced pop and flint ears, and seven all pop ears; 1885, fourteen plantings, all produced pop ears.

Zea indurata. 1883, nine plantings, of these three produced flint and dent ears, one produced flint, dent and soft ears, and five produced all flint ears; 1884, seventeen plantings, of these three produced flint and dent ears, one produced flint and pop ears, one produced flint, dent and pop ears, one produced flint and soft ears, and eleven produced all flint ears; 1885, twenty-eight plantings, of these three produced flint and pop ears, three produced flint and dent ears, one produced flint and sweet ears, one produced sweet and pop ears, and twenty produced all flint ears.

Zea indentata. 1883, thirteen plantings, of these four produced dent and flint ears, one produced sweet and flint ears, and six produced all dent ears; 1884, ten plantings, of these three produced dent and flint ears, one produced dent, flint, soft and pop ears, and six produced dent ears alone; 1885, thirteen plantings, of these five produced dent and flint ears, one produced dent, flint and pop ears, and seven produced all dent ears.

Zea amylacea. 1883, six plantings, all producing soft ears; 1884, two plantings, both producing soft and flint ears; 1885, thirteen plantings, of these one produced soft and flint ears, and twelve produced all soft ears.

Zea saccharata. 1883, five plantings, of these two produced sweet, pop and flint ears, one produced sweet and pop ears, and two produced all sweet ears; 1884, ten plantings, all producing sweet ears; 1885, forty-one plantings, of these one produced sweet and dent ears, one produced sweet and flint ears, one produced all flint ears, and thirty-eight produced all sweet ears.

This presentation is an interesting one, but it does not show the full significance, nor the part that atavism has furnished. It will be noticed that the ears noted are all of the species named, and that there are no intermediates. I propose hence to examine the crop of 1885, the seed used having been all exposed to cross-fertilization in 1884, and much of it in 1883 and 1884. The varieties as named were all compared with authentic specimens or with careful drawings. Variables which could not be named were passed by, as are also those plantings whose crop was all true to type. I have added to each name the letters A, B or C, indicating the sub-species.

Zea everta seed.

Quarantino (C). Yielded some ears of New England Twelve-rowed pop (B). A few flint kernels in crop.

White Pearl (C). Yielded some ears of Red Pearl pop (C).

Small White Pearl (C). Yielded some ears of Common Twelve-rowed pop (C).

New England Yellow (A). Yielded some ears of New England pop (A), and some of Egyptian pop (C).

Purple Rice (C). Yielded some ears of Yellow Egyptian pop (C), and some of Red Pearl pop (C).

Pearl (C). Yielded some ears of Small Pearl pop (C). A few sweet kernels in the crop.

Red Pearl (C). Yielded some ears of White Pearl pop (C).

Twelve-rowed from Amber Rice seed (C). Yielded some ears of Yellow New England pop (A), and some ears of Red New England pop (A).

Amber Rice (C). Yielded some ears of Twelve-rowed pop (B), and some ears of Egyptian pop (C).

Amber Rice (C). Yielded some ears of Red Rice pop (C), and some ears of New England pop (A).

Zea indurata seed.

French Yellow Six Weeks (C). Produced some ears of Quarantino pop (C).

Compton's Early (B). Produced some ears of Canada Twelve-rowed flint (B). Some sweet kernels in crop.

New England Eight-rowed (A). Produced some ears of Long Yellow flint (A), some ears of Canada Twelve-rowed flint (B). Some sweet kernels in crop.

Maize from Africa A (C). Produced some ears of African E. 3 dent, but yellow kernelled (C).

White flint kernels from Egyptian sweet (C). Produced some ears of Egyptian pop, some ears of Canada flint (A), and some ears of Chinese Golden flint (C). Some sweet kernels in crop.

Rural Thoroughbred (A). Produced some ears of Rhode Island White Cap flint (A), and some ears of Benton dent (A).

Flint kernels from Benton dent (A). Produced some ears of Benton dent (A), some ears of Eight-rowed Brown flint (A), and some ears of Orange flint (A).

Black flint kernels from Black Mexican sweet (A). Produced some ears of Black Mexican sweet (A), and some ears of Black Sugar sweet (B). Some flint kernels in the crop.

Flint kernels from Early Minnesota sweet (A). Produced some ears of Genesee sweet (B), and some ears of New England pop (A). Some flint kernels in the crop.

Canada Twelve-rowed (B). Produced some ears of Canada flint (A), and some ears of Early Fulton flint (B). Some sweet kernels in the crop.

Golden Dew Drop (A). All the ears Canada flint (A), and Canada Twelve-rowed flint (B).

Purple New England Eight-rowed (A). Produced some ears of Canada flint (A), and some ears of Waushakum flint (A). Some sweet kernels in the crop.

Flint kernels from Moore's Early Concord sweet (B). Produced some ears of New England pop (A), some ears of Canada flint (A), some ears of New England Eight-rowed flint (A), some ears of Chinese Golden flint (C), and some ears of African E. 2 flint (C). Some sweet kernels in the crop.

Sanford (A). Produced some ears of Silver White flint (A).

Flint kernels from Golden sweet (B). Produced some ears of Chinese Golden flint (C), some ears of Canada flint (A), and some ears of Canada Twelve-rowed flint (B). Some sweet kernels in the crop.

Flint kernels from flint kernels in Sibley's Pride of the North

dent (C). Produced mostly ears of Waushakum flint (A), and some ears of Mandan flint (A).

Flint kernels from Marblehead Mammoth sweet (B). Produced some ears of Canada flint (A), and some ears of White Pearl pop (C). Some sweet kernels in the crop.

Blue flint kernels from flint kernels on Golden sweet (B). Produced some ears of Canada flint (A), and some ears of New England Eight-rowed flint (A). Some sweet kernels in the crop.

Flint kernels from Mandan soft (A). Produced all Connecticut White flint (A) ears.

Improved Early Canada (A). Produced some ears of Smedley dent (C), some ears of Canada flint (A), and some ears of New England Eight-rowed flint (A).

Zea indentata seed.

Dent kernels from Landreth's Sugar sweet (C). Produced some ears of Forty Days flint (A), some ears of African E. 1 flint (C), and some ears of Chinese Golden flint (C) in white kernels.

Dent kernels from flint on Early Eight-rowed sweet (A). Produced some ears of Benton dent (A), some ears of Adams' Early dent (C), and some ears of Illinois Yellow dent (C). Some sweet kernels in the crop.

Chester County Mammoth (C). Produced some ears of Sanford flint (A).

Dent kernels from Ne Plus Ultra sweet (C). Produced some ears of Chinese Golden flint (C), but white kernelled, some ears of Egyptian pop (C), and some ears of Canada Twelve-rowed flint (B). Some sweet kernels in the crop.

Adams Early (C). Produced some ears of Benton dent (A), and some ears of Long Island dent (A).

Benton dent (A). Produced some ears of Waushakum flint (A).

Dent kernels from flint on Sibley's Pride of the North (C). Produced some ears of Smedley dent (C), some ears of Waushakum flint (A), and some ears of Eight-rowed Brown flint (A).

Adams Early (C). Produced some ears of Benton dent (A), and some ears of Long Island dent (A).

Champion White Pearl (C). Produced some ears of Adams Early dent (C).

African Maize E. 3 (C). Produced some ears of Chinese Golden flint (C), some ears of Waushakum flint (A), and some ears of Benton dent (A). Some sweet kernels in the crop.

Sibley's Pride of the North (C). Produced some ears of Smedley's dent (C).

Zea amylacea seed.

Red River (A). Produced some ears of Mandon soft (A).

Zuni Yellow (B). Produced some ears of Zuni Purple soft (B), and some ears of Canada flint (A).

Omaha (A). Produced some ears of Canada flint (A) in red color.

Zea saccharata seed.

Amber sweet kernels from Brighton Orange sweet (B). Produced some ears of Tom Thumb sweet (A), and some ears of Orange sweet (B). Some flint kernels in the crop.

Early Marblehead (A). Produced some ears of Amber Queen sweet (B). Some flint kernels in the crop.

Golden sweet kernels from flint on Golden sweet (B). Produced some ears of Golden Eight-rowed sweet (A), and some ears of Black Mexican sweet (A). Some flint kernels in the crop.

White sweet kernels from New England pop (A). Produced some ears of Darling's Early sweet (A), and some ears of Marblehead sweet (A). Some flint kernels in the crop.

White sweet kernels from New England pop (A). Produced some ears of Minnesota sweet (A), and some ears of Amber Cream sweet (B). Some flint kernels in the crop.

Minnesota (A). Produced some ears of Eight-rowed Early sweet (A), and some ears of Amber Cream sweet (B). Some flint kernels in the crop.

Moore's Early (B). Produced some ears of Golden Eight-rowed sweet (A). Some flint kernels, and some dent kernels in the crop.

Black sweet kernels from flint on Golden sweet (B). Produced all Black Mexican sweet (A) ears. Some flint and some soft kernels in the crop.

Asylum (B). Produced some ears of Amber Cream sweet (B),

and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Alexander's sweet (A). Produced some ears of Amber Cream sweet (B), and some ears of Eight-rowed Early sweet (A). Some flint kernels in the crop.

Black sweet kernels from Brighton Orange sweet (B). Produced all Black Mexican sweet (A) ears. Some flint kernels in the crop.

Dolly Dutton (A). Produced some ears of Narragansett sweet (A). Some flint kernels in the crop.

Black sweet kernels from Crosby's Early sweet (B). Produced some ears of Black Sugar sweet (B), some ears of Crosby's Early sweet (B), and some ears of Dwarf Early sweet (A). Some flint kernels in the crop.

Half sweet and flint on same kernels from Crosby's Early sweet (B). Produced some ears of Eight-rowed Early sweet (A), but kernels all black, and some ears of Crosby's Early sweet (B). Some flints kernels in the crop.

Black Mexican (A). Produced some ears of Amber Cream sweet (B), but black kernelled. Some flint kernels in the crop.

Ne Plus Ultra (C). Produced some ears of Eight-rowed Early sweet (A), and some ears of Hickox sweet (B). Some flint, some soft and some dent kernels in the crop.

Yellow sweet kernels from flint on Early Eight-rowed sweet (A). Produced some ears of Golden Eight-rowed sweet (A), some ears of Golden sweet (B), and some ears of Benton dent (A). Some flint kernels also in the crop.

Half sweet and flint in same kernel from Early Minnesota sweet (A). Produced some ears of Minnesota sweet (A), some ears of Narragansett sweet (A), and some ears of Eight-rowed Early sweet (A). Some flint kernels in the crop.

Black sweet kernels from Brighton Orange sweet (B). Produced some ears of Orange sweet (B), and some ears of Black Mexican sweet (A). Some flint kernels in the crop.

White sweet kernels from Brighton Orange sweet (B). Produced some ears of Tom Thumb sweet (A), and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Tom Thumb (A). Produced some ears of Minnesota sweet (A). Some flints and some some soft kernels in the crop.

Dwarf Early (A). Produced some ears of Eight-rowed Early sweet (A), and some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Landreth's Sugar (C). Produced some ears of Long Yellow flint (A). Sweet kernels and dent kernels in the crop.

Marblehead Mammoth (B). Produced some ears of Genesee sweet (B). Some flint and many dent kernels in the crop.

Amber Cream (B). Produced some ears of Crosby's Early sweet (B). Some flint kernels in the crop.

Black Mexican (A). Produced some ears of Black Sugar sweet (B). Some flint, some soft and some dent kernels in the crop.

Squantum (C). Produced some ears of Genesee sweet (B). Some flint, some dent and some soft kernels in the crop.

Egyptian sweet (C). Produced some ears of Crosby's Early sweet (B). Some flint and some dent kernels in the crop.

The number of plantings that produced off and named ears and off kernels in their crop, according to their species, are summarized in the following table:

	No. of plantings.	Pop.		Flint.		Dent.		Soft.		Sweet.	
		Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.	Ears.	Kernels.
Zea everta, ...	10	—	—	0	1	0	0	0	0	0	1
Zea indurata, ...	20	5	5	—	—	4	4	0	0	2	11
Zea indentata, ...	11	1	1	6	6	—	—	0	0	0	3
Zea amylacea, ...	3	0	0	2	2	0	0	—	—	0	0
Zea saccharata, ...	28	0	0	1	28	1	8	0	5	—	—

This phenomena of atavism, as the outcome of the crossing of corn, has apparently escaped the notice of writers, and the testimony here furnished is in evidence of its frequent occurrence.

In 1882 seed of Waushakum flint was planted alongside many other varieties, and exposed to crossings of many sorts. No influence of other pollen was observed in the crop. In 1883

seed from the 1882 crop was again planted on a half-acre area greatly exposed to the pollen of over 100 kinds. In this crop no influence of other varieties was to be seen. In 1884 the same condition of things, and the resulting crop purely on type. So again in 1885. We have here a strong piece of evidence in favor of the resistance to crossing from plants from pure seed. Similar instances are afforded by the Silver White flint and the Minnesota dent. The former has been the only variety grown from time immemorial by the few farmers in a secluded valley in Orange county, N. Y., and the latter seems to be the only variety of dent grown near Ogdensburg, N. Y. *Per contra*, one plot of Waushakum flint was alongside a plot of Minnesota dent in 1882. In 1883 seeds from both plots yielded a crop of corn partly Minnesota dent and partly Waushakum flint, and no intermediates.

It is to the rarity of intermediates and the prevalence of atavism that we may look for the explanation of the frequent statements of flint changing to dent or dent to flint when seed has been obtained from distant localities; a result popularly ascribed to influence of climate. It is to be observed that the change is always towards the prevailing variety of the locality where the attempt is made. Let us offer a supposed instance for illustration. A farmer in Maine, where flint corn is exclusively grown, plants some dent corn on trial. The plants become hybridized from the neighboring plants. The next year's sowing yields flint and dent ears, the former ripe, the latter immature at the period of harvest. The ripened seed, that is, the flint, is saved for next year's use. The next year the crop is almost entire flint, and the farmer certifies at his next corn-talk that dent always changes to flint in his climate. The result here is influenced in great part by an unconscious selection. This illustration also seems to hold true in explaining the statements that Canada flint becomes larger when removed southward. This may be true, but I know of no good evidence in favor of such a change being produced by climatic conditions alone, although I admit its possibility. The Dwarf Golden pop, very small kernelled, retains its character for years, as grown by some farmers, not even changing to the very near but larger eared Golden pop of our seedsmen. One striking illustration may be offered. In 1883 I received some Minnesota dent

corn from New York which had been grown near the Dutton flint. The ears and the kernels were apparently the true Minnesota dent. The crop was a flint corn, the dent character having largely disappeared. This change in variety receives again illustration in a planting of Dwarf Golden pop. The ears were from 1–2¼ in. long, with a bright yellow kernel. Thirty-six plants grew, of these thirty-two were two feet tall, the ears all like the seed except that one ear had a few sweet and flint kernels. The remaining four plants were four feet tall, and the kernels were all sweet, flint or Tuscarora soft, with not a pop among them.

From the data we have given it would seem that there is a ready cross-fertilization within each species, and a resistance, not very complete, to hybridization. But more work is yet required before accepting this conclusion.

In this "note" I have sought to indicate how nomenclature can be applied to simplify the study of such a confused mass of material as is furnished through the crossing of maize.

XII.

May 14, 1894, I received from Dr. Wm. Saunders, Director of the Canada Experimental Farms, a sample of the Squaw flint corn grown at Rat Portage, Lake of the Woods, lat. 50° N. The description of this variety, as made out from the cob and detached grains, is as below. Ear eight-rowed, six inches long; the ear stalk large. The taper quite pronounced from the slight dichotomous openings towards the butt, and the decreased breadth of the kernels towards the tip. Kernels broader than deep, very flinty, but the corneous matter rather thin; the larger ones $\frac{7}{16}$ inch broad. Colors mixed, some kernels dingy white, others of shades of yellow, light purple or blue. The cob, rather squarish in section, and white; the interior reddish, the pith soft and well defined. This variety seems to be the same with the Blue flint of Northern New England, but the ear tapering and more squarish, although not more so perhaps than in individual selections from a crop of the Blue corn. The dichotomous arrangement of the kernels and the openness between pairs can be understood by examining specimens of flint tassel corn. It will be noticed with this tassel corn that the tassel branch becomes changed on one side to a

kind of triangular cob bearing two rows usually, when many kernels are found, although single kernels may occur in a scattered way. If four of these dichotomous kernelled branches be collected and tied together to form an ear we would have an eight-rowed ear with distinct openness between the pairs of rows. If search be made in a crop of flint corn we shall very likely find ears that are but partially kernelled, the kernels being scattered here and there only over the cob. These kernels are of the type of their species, but rounded through the removal of pressure against adjoining kernels, and often as thick as broad. The relations of these kernels to the cob are however of the greater interest. Where no kernels are found the cob is rather undeveloped; when the kernels are absent over a considerable space, even flimsy, but thickening again as the kernels appear. The cob hence varies in diameter according to the presence of kernels. If the observer is very fortunate he may find a cob with kernels in groups of different size. In this case he will observe that there is a tendency in the cob to develop according to the size of the kernels, as well as according to their number. We here have a plausible explanation for the taper in ears where the kernels diminish in size towards the tip; and this decrease in size of kernel, together with slight dichotomous openness in the upper portion, may give an ear of a most decided taper. I have frequently noticed in varieties of flint and sweet corn that the unripe ears always are tapering. This seems to be accounted for by the development of the kernel from the base upward; the butt kernels fertilizing first, the tip kernels last, and often quite an interval of time between. If these unripe ears be plucked at the period coincident with the commencement of the hardening process, or even in some cases slightly before, and allowed to continue the process of ripening from the stored material it will be noticed that the ear ripens but the taper remains, as the kernels do not increase equally in size. This explains, perhaps, the number of tapering ears in a belated crop of a variety whose normal ear would be described as cylindrical, but tapering towards the tip. This Squaw flint grown at a point somewhat near the extreme northern limit of the species, where the season is short, is, as we have seen, tapering, while the apparently same variety as grown in the Northeast

is described as cylindrical or tapering very slightly at lower third. Since my description of Canada corn in 1884, as strictly of a cylindrical type, I have noted that I have observed among specimens of this type from northern localities some tapering ears. I have not sufficient data for generalization on this point, but it suggests itself that in any variety grown near its northern limit we should expect this variation to occur, a variation not incident to the variety, but to be ascribed to the accidental circumstance of harvest. Thus in the Black Mexican sweet, whose type of ears is cylindrical throughout, we often find belated ears which are distinctly tapering. This apparent change of type, as between normal and belated ears, is especially evident in the sweet corn, and has worked much confusion in the attempts at nomenclature.

We observe that our Squaw flint has various colored kernels on the cob. I readily pick out one dingy white, three shades of yellow, three shades of light purple, and two shades of blue. This mixture of colors is also to be noticed in the Mandan soft corns of Michigan and the Zuni soft corns of New Mexico, as also in others. Blue corn from Hanover, N. H., planted in 1884, yielded a crop described as copper-yellow, with some blue and slate-colored kernels, and many red-striped kernels. Whether these distinctly colored kernels arise through cross-fertilization or are a variety character can perhaps be determined by the planting of single kernels. It is possible that the colors from each seed come pure, and that the mixture is the result of current cross-fertilization between varieties. I have not the data for an answer. In my previous paper I have discussed current fertilization between species. Here I may be permitted to offer evidence of current fertilization between varieties as well. The experiment was with named varieties of flint corn, which, as experience has shown, would have yielded in all probability single colors had they been planted apart. As it was, these were planted subject to crossing from very numerous varieties of all the species. The colors grown together were white, yellow, red and purple pops; white, yellow, copper-red, purple and purple-brown flints; white, red and yellow dents; slate, pink, black, yellow and white softs; and white, amber and black sweets. The results noted for these flint corns were as below:

Forty Days' Early White. 34 ears, all flint. Yellow, white and pink striped kernels.

Eight-rowed Brown. 30 ears, all flint. Purple-brown, copper-red, yellow, red-splashed, slate and black kernels.

Eight-rowed red-glazed. 31 ears, all flint. Yellow, copper red, white, slate, red and splashed kernels.

Waushakum. Pure seed. 16 ears, all flint. Yellow kernels.

Waushakum. Station grown seed. 21 ears, all flint. Yellow, slate and red-splashed kernels.

Improved King Philip. 31 ears, all flint. Yellow, red-blazed, copper-yellow, black, slate, blotched and speckled kernels.

New England Twelve-rowed. 1 ear, all flint. Yellow and white kernels.

White flint. 28 ears, all flint. White, yellow, black and pink splashed kernels.

Red Nose White. 35 ears, all flint. White, yellow, pink, purple and blotched kernels.

Early Dutton. 29 ears, all flint. Slate, white, yellow and red splashed kernels.

Eight-rowed Purple. 23 ears, all flint. Purple, yellow, copper yellow and red-striped kernels.

Rural Thoroughbred. 15 ears, all flint. White, yellow and blue kernels.

Our Squaw flint is an eight-rowed corn. There seems to be a corelation between this and climate. In New England the great predominance of eight-rowed varieties is significant, yet there is an eight-rowed and a twelve-rowed Canada, but I have no record of the comparative frequency of the two varieties. The samples of soft corn sent me from the Red River region of Manitoba were eight-rowed, so also the dent varieties from Dakota. In my description of 44 varieties of flint corn in 1884, 28 eight-rowed varieties are suited for New England growing, and 8 twelve-rowed, two varieties, twelve-rowed, being foreign and hence not ascribed to American location. Those varieties which are more distinctly Southern or Western comprise one twelve-rowed, and five over twelve-rowed. Yet, since writing the above, I have received a small twelve-rowed variety of a slate or bluish black pop, which is said to ripen in eighty days in Massachusetts.

XIII.

In 1878 I received from the Peabody Museum collection a sample of corn taken from a Peruvian Huaca, and figured the same in the New York Agricultural Experiment Station Report of 1884. I also saw another like ear from the Cambridge Botanical Museum. In August, 1894, I received from Professor F. W. Putnam three samples from the Peabody Museum representing three varieties from ancient burials. Wittmack, whose specimens came mostly from Ancon, Peru, is quoted by DeCandolle as testifying that the number of varieties were quite considerable. The only varieties that I have noted described are two. Rivero and Tschudi say the ears buried with the corpse were of two very rare kinds. In one the ear short, dry and a little curved at the point; the other a large thin ear, with large grains almost triangular at the point, very much twined, with the grains covering it like the tiles of a roof. He then mentions a "petrified" ear in the possession of the botanist Robert Brown, which was one of these varieties, and which he calls *Zea rostrata*, Bonafous. DeCandolle refers apparently to this "petrified" ear, but he calls it "un imitation sculpter." In the Department of Agriculture Report of 1870 there is figured an ear in the possession of the Smithsonian Institution which was taken from an earthern vessel eleven feet under ground, in a grave with a mummy. From the figure little can be made out except the irregular arrangement of the kernels, but the description says 4½ inches long, 13 rows, the grains rather sharp-pointed, small, slightly indented at the apex, lapping over each other. The appearance is that of a soft corn.

This datum, all I have, is scarcely sufficient for the purpose of a study or for generalizations concerning "mummy corns," but there are some few points that can be referred to, and an accurate description of the four varieties may be of service as a record. The kernel color of these Peruvian samples is uniform chocolate brown, or the same with a more reddish tinge; of the Chilian samples a port-wine glossy red. The brown-chocolate we assume is a change induced by age. The split kernels show all starchy matter, of a dull white, and no corneous matter. The species is hence *Zea amylacea*, but the question recurs whether or not the

internal structure has been changed by age; this we cannot answer. The kernels in all are deeper than broad, hence subspecies C.

No. 1. Mummy corn from Peru. Ear-stalk small. Ears about 4 in. long and 2 in. in diameter, cone-form or strongly tapering from a large and rounded butt to a rounded tip, about 23 kernels in a row, 18-rowed. No sulci between rows. Kernels 5/8 in. long, 1/4 in. broad, the apex flat with slightly rounded corners, and the sides but little tapering, hence rather rectangular in outline, indented, slanting forwards a little in their position on the cob, hence giving an appearance of imbrication to the ear. Color externally a chocolate brown, internally a dull white. Structure all starchy matter, hence *Zea amylacea*.

No. 2. Mummy corn from Ancon, Peru. Expedition of F. A. Agassiz. Ear-stalk small. Ear 4 in. long, 1 1/2 in. in diameter, tapering but slightly, the kernels rounding strongly over butt and tip, 19 kernels to a row, 12-rowed. No sulci between rows. The kernels 5/16 in. long, 3/8 in. broad, distinctly creased indented, the apex flattish, the corners well rounded, the sides slightly tapering, set upright or at right-angles with the cob. Color externally chocolate brown, internally a dingy white. Structure all starchy, hence *Zea amylacea*.

No. 3. Mummy corn from Ancon, Peru. Expedition of Geo. A. Dorsey, 1891. Ear-stalk small. Ear 5 1/4 in. long, 1 3/4 in. in diameter, not filled at extreme tip, no sulci between rows, very close kernelled, nearly cylindrical, kernels rounded strongly over butt, tapering and finally pointed towards tip, 26 kernels in a row, 16-rowed; the kernel surface compressed, leaving a flat triangular apex with the point forward. The kernel nearly 1/2 in. long by 1/4 in. broad, the apex flat with very slightly rounded corners, triangular in shape, and a point projecting at right angles on the chit side, the sides slightly tapering, set upright on the cob, the point overlapping slightly the kernel in front, thus giving the appearance of imbrication. Color externally chocolate brown with a reddish tinge, internally a dingy white. Structure starchy throughout, hence *Zea amylacea*. This ear corresponds somewhat with the second variety of Rivero and Tschudi, but it is not *Zea rostrata*.

No. 4. Mummy corn from Iquique, Chili. Expedition of Geo. A. Dorsey, 1891. Ear-stalk small. Ear 3¼ in. long, 1½ in. diameter, tapering, rounded over butt and tip, no sulci between the rows, which are a little irregular, very close kernelled, about 17 kernels in a row, and 20-rowed. The kernels $\frac{7}{16}$ in. long, ¼ in. broad, strongly rounded at summit, tapering at the sides, set upright on the cob. Color externally a deep port wine glossy red, internally a dullish white, not as dingy as in Nos. 2 and 3. The structure all starchy matter, hence *Zea amylacea*. The general appearance of the specimen is that of a large kernelled very flinty pop corn. The kernels are so densely compressed that a horizontal section shows a polygonal outline, as is so readily observed in some varieties of Pearl pop.

XIV.

It is singular that nearly all the early corns mentioned in my Note II. were from Southern localities, as Nicaragua, Brazil and Paraguay. This was brought to my attention by noticing that the Cinquanto corn from Greece is one of the few varieties that ripens at Ottawa, Canada. The Danubian corn of Southeastern Europe, which to some extent enters into commerce, as near as I can find out, belongs to the Golden pop class, which is an early type, and Humboldt, it will be remembered, refers to a two-month variety in Hungary, the same as found in Nicaragua and on the banks of the Amazon river. The earliest variety I have ever grown is the Dwarf Golden pop which ripened in about 70 days from planting. The next earliest variety was the 40 days, a flint in some respects reminding of Canada flint, and which was ripe in 75 days, The only high Northern corn whose period of growth I find given is the Mitchell's Extra Early flint, gained by selection from the Native or Squaw flint of the Northwest. At Ottawa it required 110 days to ripen; at Nappan, Nova Scotia, 111 days in 1892, 126 days in 1893; at Agassiz, British Columbia, 138 days. In these regions it seems that this corn is harvested before it becomes as hard as with us.

The height of the corn plant varies considerably with the same variety, as also the time required to mature. Thus the Iowa

Experiment Station reports in 1888 on the Leaming dent, seed from four sources, as below:

	Height of plant.	Height of ear from ground	No. of blades to a stalk.	Days maturing.
Leaming (from Gregory)	9½ ft.	3¾ ft.	12	110 "
" (from Livingston)	9½ ft.	3¾ ft.	13	115 "
" (from Maule)	10¼ ft.	4¾ ft.	14	125 "
" (from Johnson & Stokes)	10½ ft.	5¼ ft.	15	128 days.

Further particulars from the State station reports are:

Leaming,	Illinois, 1888,	11¼ ft., tall.	Season 135 days.
"	Connecticut,	8 ft. tall.	
"	Ottawa, Can., 1889,	8 to 9 ft. tall.	
"	" " 1890.	7 to 10 ft. tall.	

Further illustrations are:

	Iowa, feet.	Illinois, feet.	New York, feet.	Ottawa, feet.
Adams' Early dent,	—	4¼ to 6½	5½	6 to 8
Minnesota Sweet,	4½ to 5	—	4½ to 5½	6 to 7

The height of the same corn in different years and planted at intervals of one week is given for Burr's White dent in the Illinois reports.

1891,	Eight plantings,	$7\frac{5}{6}$ to 8½ ft.,	Average 8 ft.
1892,	"	$7\frac{1}{8}$ to 9 ft.,	Average $8\frac{5}{12}$ ft.
1893,	Seven plantings,	$5\frac{7}{12}$ to $7\frac{2}{3}$ ft.,	Average 6¾ ft.

Two well known varieties of sweet corn are Crosby's Early and Stowell's Evergreen, both largely grown and used for canning purposes.

	Crosby's Early, Height in feet.	Stowell's Evergreen, Height in feet.
Michigan,	4	5¾
Illinois,	5½ to 7	6 to 8
New York,	5½ to 6	5½ to 7½
Pennsylvania,	6	6
N. W. Territory, Can.,	4½	—
Manitoba,	7	5 to 5½
Ottawa, 1889,	6½ to 7	5½ to 7
" 1890,	4½ to 5	5 to 6½

Would it be safe, then, to generalize from these figures that a northern climate increased earliness and decreased size in the corn

plant? Yet this is the popular belief. On the contrary our presentation shows no such conclusions.

The Canada Yellow is reported as 5 to 6 feet tall from Ottawa and Manitoba. Mitchell's Extra Early flint, at Ottawa, grows to a height of 5½ to 6½ feet. Canada flint, from the Province of Quebec, at New York station, 1884, grew 6½ feet tall; and the Canada Twelve-rowed, from P. Q., grew 6½ feet tall. These few observations, put in evidence, suggest also like interesting reflections.

I have as yet insufficient experience or study to venture upon a statement as to the influence of climate upon maize except in its most general relations; of one thing I am assured, and that is the permanence of variety types under varied conditions, in every case I have met where there was reasonable prevention of interpollenation with other varieties. Thus the Dwarf Golden pop, whose ovules are fertilized before other varieties come into bloom, is a permanent feature to some gardens. In Northern Maine, where the crop is only grown on hill-sides to escape the early frost of the lowlands, standing thus remote, the variety seems to have remained true from the earliest periods. At our local agricultural fairs the same variety is often exhibited year after year, and no apparent change within the memory of observers. A search in Northern Maine or New Hampshire brings to our knowledge a few fields of corn which is presumably the Blue corn of the aborigines. The corn found with the Arizona mummy at the National Museum seems identical with the varieties grown by the present Indians of that region. So far as I know, in any climate suited to corn culture, any variety that matures between the period of local planting and local frost will grow and keep its characters intact. Perhaps a greater knowledge might cause me to change this statement.

The idea that we must go north for our seed is thus seen to be untenable, except so far that we only find corn in the north that will mature within certain periods. Far more plausible is the idea that we must seek an earlier corn by finding an earlier variety, whether north or south. Thus the Cinquanto from Greece ripened at Ottawa, while the King Philip which originated from New Hampshire is reported as only nearly ripe, and the Dutton, a New England form, as only in early milk.

Per contra, to this estimate of climate relations, I would call attention to the statement in my Note X. regarding the Mexican Indian corn and the *Zea canina*.

It is an interesting fact, which would not have been predicted by botanists, that in and about Farmington, Maine, where the Stowell Evergreen sweet does not ripen its seed, there is a large canning industry, and that the State of Maine cans more sweet corn than any other one State, amounting to 614,894 cases in 1891.

XV.

The application of hot water to starch causes it to become plastic. This fact seems to underlie the explanation of the popping of corn. Pop corn contains starch granules arranged within a tough endosperm. When heat is applied the starch becomes plastic, and the water furnishes steam which soon explodes the kernel, and, turning it inside out and expanding the starch, forms a large fluffy snow-white mass. It is only the corneous matter of the pop corn that furnishes the expanded mass of popped corn. When, as is sometimes the case, a small spot of starchy endosperm occupies the lower portion of the kernel, this remains unchanged or simply toasted. Flint corn does not pop becuuse its corneous endosperm is too thin. Upon the appliication of heat it does not evert, but only spits. From pop corn, therefore, we gain popped corn; from flint corn simply toasted corn or parched corn. Sweet corn and soft corn simply toast, and all the dent corns I have tried simply toast or spit.

When we consider the delicate quality of popped corn and its handsome appearance, as also its large consumption, both in its popped state and as candied, it is a matter of surprise how infrequent is the mention of it in books or other publications. Harshberger says that Dr. Franklin mentions an Indian preparation. "A vessel of sand was heated. The corn was then mixed with this sand and slowly heated until the grain burst. It was then taken out and ground to a fine powder, which kept fresh for a number of years, Heckewelder calls this preparation *psindamocan*." Romans, in his "Natural History of Florida," writes that the natives "parch and then pound it, taking this pounded mate-

rial on long journeys." According to Lambert's "History of the New Haven Colony," the Connecticut Indians called parched corn pounded, *yeokheag;* parched corn made into hominy, *roucheage.* The only other Indian names I have found for parched corn are: Caddo, *kishwanto;* Cherokee, *kungwisitung;* Choctaw, *tanchi vluvsha;* Mohawk, *ounouquit-zerleh;* Muskhogee, *achiaposiki;* Seneca, *onaershewfquaw.* The Quichuas of Peru call toasted maize *cancha. Pinole* is an Aztec word applied to any kind of grain or seeds parched and ground before being made into dough. I am unable to determine whether the word parched was used as synonymous with toasted or whether it refers to popped, but I suspect the former.

SOUTH FRAMINGHAM, October 4, 1894.

Japanese Characeae—I.

BY T. F. ALLEN.

These observations will be continued as collections come to hand, and for the present no attempt will be made to systematize the species.

1. CHARA FRAGILIS Desv. A slender form of this species, differing in no particular from forms collected in other countries. The cortex is tolerably regular; the primary series most prominent, the papillae undeveloped. The bracts are unilateral and equal the oogonium in length, the latter immature.

2 and 3. CH. CORONATA A. Br. Three collections of this species have been made, all in the vicinity of Tokio; one form seems to be longer, with long leaves (probably from deeper water). It does not differ from the ordinary forms, even the minute tuft at the apex of the leaves, composed of the terminal cell with two or three elongated nodal bracts, is similar; this form is microcarpa, microptila, unilateralis. The coronula of the oogonium is short with spreading tips, the subtending bracts only half the length of the oogonium, the oospore small, 540 long, 306 broad.

4. NITELLA JAPONICA Allen, Bull. Torr. Club, **20**: 120; **21**: *pl. 188.* Province of Tokio.

5. N. MUCRONATA TENUIOR A. Br. This beautiful form was collected in the province of Ise, and doubtless is to be referred to this variety. The leaves (6) are at times 3-divided (flabellata), and now and then the sub-terminal is septate, thus connecting it with *N. gracilis* Kutz. The whole plant is very slender, leaves 170 in diameter, mucro 34 in diameter at base. The oogonia are usually solitary in both divisions of the leaves; the oospore averages 306 long, 270 broad, with 6 striae; the surface reticulated, the reticulae 2 to 7 in diameter (easily seen with a half-inch lens).

6. N. JAPONICA Allen; from province of Ise.

7. N. ORIENTALIS sp. nov.

Nos. 7, 8 and 9, though variable, may belong to the same species. Plant 6–8 inches long, repeatedly branched, the verticils often densely tufted when young. Leaves 3–4-divided, terminals very slender, of variable length (elongated or very short); oogonia one (or two) at a node; coronula short and small, but the apical cells much longer than the sub-terminal, which are small and disk-shaped. Antheridium 275 in diameter, oospore 306 to 340 long by 270 broad (in our specimens immature).

8. Plant 8 to 10 inches high, very slender, with remote verticils (spreading), consisting of 6 to 8 leaves. Leaves diarthrodactylae, four times divided, terminating in a mucro; the ultimate segments unequal, at times elongated and slender, at times quite short (brachydactylae); the leaf 200 diameter, the first segment 156, the second (102) to 150, the third (88) to 142 the terminal 88 to 95 in diameter, the mucro 55 to 60 long.

Oogonia clustered (2 to 3) at the nodes of the leaves, coronula not elongated, cells connivent, 60 broad, 48 high, and oospore 272 to 306 long, 170 to 240 broad; (measurements of several mature oospores, give length and breadth as follows, 340 by 292, 353 by 306, 360 by 292, 368 by 292, 368 by 306, 368 by 319); with 8 rather blunt ridges, rarely 7 or 9; surface minutely roughened with granules, which are quite coarse and more prominent at one or two points on the shell, usually near the apex.

9. Plant very delicate, often minute, 3 to 4 inches long; leaves 3–4-divided; stem diameter 102, leaf first node 75, second 60, third 36, fourth 34, mucro 70 long, very slender. Antheridia only 75

in diameter; oogonia clustered, oospore 272 to 306 long, 170 to 240 broad; surface too immature to examine. This plant occurs very sparingly among the collections of number 8, which I have received; it is probably a reduced form of that species; its extreme delicacy is shown by the measurements of stem and leaves. These forms 7, 8 and 9 belong to the section *Polyglochin* or diarthrodactylae — brachydactylae — subdivision of *Nitella*. The oogonia being clustered (not isolated at the nodes of the leaf) place the species near the three American sub-species, *microcarpa* A Br., *Glaziovii* Zell, and *megacarpa* Allen, all doubtless forms of one species for which *microcarpa*, the oldest name, is very inappropriate. These species as well as *oligospira* possess oospores with a reticulated membrane, quite distinct from *N. orientalis* Allen; indeed *N. Japonica* Allen is to be included in this group, it was erroneously referred by me to the *oligospira* section, but later collections show distinctly clustered oogonia; the cells of the coronula are however elongated, placing it in alliance with the true *N. polglochin* series, which is separated by coronula characteristics from our *N. orientalis*, which has a short coronula. Illustrations of these new Japanese species will follow later when a series of eight plates can be prepared.

10. NITELLA PAUCICOSTATA sp. nov. Monarthrodactyla, furcata, homoeophylla, gymnocarpa, dioica, apiculata, membrane of oospore granulated. (Series of *N. opaca* Ag.)

Plant 2 to 6 inches high, branched from the base, diffuse and flaccid. Verticils remote, at length becoming crowded above, bearing about eight leaves and usually short peduncles (shoots) which fruit abundantly when very short, close to the base of the verticils. Leaves once divided, often long and slender (bright green and flaccid in our specimens); terminal segments three, about as long as the first segment of leaf, abruptly pointed (like *N. opaca*). Stem 366 to 500 in diameter; leaf first segment 146 to 425 usually 300 diameter; second segment, 170 to 220 usually 170 diameter. Fruit clustered at the node of the leaf; oogonia 2–3, globular; coronula minute, evanescent; oospore about 408 long by 340 broad (400 by 340, 408 by 380, 440 by 374, 440 by 360, 440 by 370); membrane of oospore very minutely roughened; ridges only 4 (or 5); antheridia 488 in diameter.

This species was collected near Tokio, and adds another to the multiplying *opaca* series. In reviewing the species of

this series which have roughened oospores, we find that only *N. obtusa* Allen has apiculate leaves; the others have acuminate leaves. From *N. obtusa* the Japanese species is easily distinguished by its small size and small leaves and by its smaller oospore with very few striae or ridges.

Note on Chara sejuncta A. Br.

By T. F. Allen.

Chara sejuncta A. Br. is one of our common plants, but so variable that extreme forms might well be taken for distinct species. The stem is at times covered with long spines; the bracts on the nodes of the leaves as long as or longer than the oogonia; the lowest (naked) segment of the leaf (often a distinctive specific character) is also variable as to length and size. The size of the oospore also, usually the most reliable diagnostic feature of a species, varies greatly. Like other species, the stems may be elongated, slender and diffusely branched, or condensed, stout and simple; of this latter feature no note need be made, but of the size of the oospore and of the length of the bracts in relation to the size of the oogonia, and of the spines to the diameter of the stem, a word is timely. A Mexican form collected recently by Mr. Pringle gives us spines one-half the diameter of the stem in length, lowest leaf node equaling the stipules, anterior bracts one-half the length of the oogonium, oospore with 12–13 ridges, 535 long, 300 broad; antheridium 190 in diameter. These measurements are peculiar and hitherto unique.

This summer I have collected in Lake Champlain and Saratoga Lake (in both localities), always in company with *Chara gymnopus elegans* A. Br., a form with oospores 756 long by 480 broad, having 11 ridges, the bracts quite unilateral, the anterior one-third to one-half the length of the oogonium, the posterior minute and not noticed, the naked node as long as the upper row of stipules; the spines of the stem numerous and minute. The plants are short and compact, of a curiously smooth naked appearance, especially in Lake Saratoga, where they are not so encrusted as in Lake Champlain. This form should be designated as *Chara sejuncta* A. Br., forma compacta, sub-inermis, microptila, unilateralis macrospora.

Orthotrichum gymnostomum Bruch.

By G. N. Best.

This rare moss was collected for the first time in North America by Rev. A. C. Waghorne, at Upper Sandy Point, N. F., on the 28th of April last. It appears to have been first found in Germany by Bruch, who gave a description of it in Bridel's *Bryologia Universalis*, 1826. It was afterwards collected at a few places in that country, also in Norway, in Sweden, possibly in England, and more recently in France.

Material for comparison is scarce, and the only specimen I could obtain was a Swedish one kindly loaned me by Mrs. E. G. Britton. Our plant differs from that in being taller, the papillae smaller, ortherwise the agreement is perfect.

Since it is now known that *Orthotrichum gymnostomum* is to be found in this country our botanists will be on the lookout for it, and in order that they may recognize it a brief description is given.

It grows on poplars, in yellowish-green tufts reddish-brown within; stem ½ to 1 cm. tall, erect, rigid, usually simple, sometimes branching, with one or more clavate innovations; leaves when dry closely imbricated, when moist spreading, oblong-ovate concave-carinate, obtuse with the margin involute except at the base, nerve narrow, disappearing under the apex; perichetial similar but longer, oblong-lanceolate, usually plane at the rounded or blunt apex; areolation angular, middle basal cells broadly linear, quadrate at the angles, upper oblong-rhomboidal, apical oval or roundish, each cell with one or two stout papillae, these sometimes bifurcated.

Dioicous; male plants smaller in seperate tufts or mixed with the female; calyptra plicate, conical, hairless, rough and black at apex, scarcely covering one-third of the capsule; operculum narrowly conical from a convex base; capsule immersed, oblong-ovate, oblong when dry and empty, rounded at the truncate base, without peristome, neck shorter than sporange, stomata superficial, only a few and these near the mouth, bands eight, yellowish, composed of two to four rows of yellowish thick-walled cells; pedicel very short.

Although closely related to *Orthotrichum obtusifolium* Schrad., it may readily be distinguished from this by the angular cells,

involute leaves, absence of peristome and the neck shorter than the sporange.

ROSEMONT, N. J.

Microsphaera densissima (Schwein.) Peck.

BY GEO. F. ATKINSON.

This very interesting species first described by Schweinitz* as *Erysiphe densissima*, was collected by me at Ithaca, N. Y., August 7, 1893. There has been some uncertainty as to the identity of this species of Schweinitz, and probably for this reason Burrill omits a description of it in his latest work on the Erysipheae.† It is only mentioned in a discussion of its once supposed identity with a very different fungus, *Microsphaera calocladophora*,‡ Atkinson. In his article on the Erysipheae§ of Illinois, Burrill refers to it as follows: "*Microsphaera densissima* (Schw.) Peck, cannot be distinguished by its perithecia from the ordinary form on *Q. rubra;* but it presents some peculiarities of the mycelium, which if constant would entitle it to specific distinctness." The specimens agree perfectly, it seems to me, with Schweinitz' description, the patches of whitish mycelium being very dense with a long filamentous tomentum. The patches are beautifully orbicular, the prostrate threads lying close to the leaf and beautifully radiate from the center. The portions of the leaf on which the mycelium is seated are very much injured, so that they become yellowish and marked with numerous black spots on the lower side. It occurs at Ithaca on *Quercus tinctoria*. According to Burrill, Peck reports it on *Q. tinctoria*. In the 26th Report of the New York State Museum, p. 80, Peck reports it on fallen leaves. Several years ago while studying the species‖ which occurs on *Q. aquatica* and *Q. laurifolia* in the Southern States

* Syn. Am. Bor. n. 2479.

† Ellis' North Am. Pyren. 29.

‡ Some Erysipheae from Carolina and Alabama. Jour. Elisha Mitchell Society 7: 13.

§ Bull. Ill. State Lab. Nat. Hist. 2: 426. 1887.

‖ *Microsphaera calocladophora* Atkinson. See note ‡.

I was enabled through the kindness of Dr. Peck to examine a specimen of the fungus which he referred to this species. The specimens which I have collected at Ithaca agree perfectly with those collected by Dr. Peck. The fungus has occurred again at Ithaca during the summer of 1894, on the leaves of the same oak tree.

Fissidens hyalinus in Pennsylvania.

Fissidens hyalinus, according to Icones Muscorum and the Manual, is a very rare moss, since it has been found in only two places and is extinct in these. We have been able, however, to gather small quantities of it in four different places. We first met with it growing on the steep banks of a moist shaded ravine, along with *F. taxifolius*, and by searching similar ravines, and using *F. taxifolius* as a guide, we found it in three other places. Possibly then this little moss is more widely distributed than has been supposed, and has been simply overlooked on account of its insignificant appearance and the small quantity of it growing in one spot.

A more careful search might discover it in many parts of the country. The *F. taxifolius* may serve as a guide. Where this grows on the moist banks of shaded ravines, our little moss may be searched for. The best time for the search is from September to November, when it is in fruit; for its red peristome will betray its presence to a sharp eye held near the ground. It is a good plan to take up slices of earth where smaller plants of *F. taxifolius* grow somewhat loosely, and examine these with the aid of a good magnifying glass. The red peristome of *F. hyalinus*, if it is in fruit, is readily detected, and its leaf is easily recognized from the fact that it is without a costa, and its large cells give it a resemblance to the leaf of *Physcomitrium*.

This moss does not grow in thick and wide-spread mats which would discover it to the eye notwithstanding its small size; clusters of 20 to 50 plants may be found, but much more frequently it grows separately.

Alonzo Linn,
Jas. S. Simonton.

Washington and Jefferson College, Washington, Pa.

Proceedings of the Club.

TUESDAY EVENING, NOVEMBER 13TH, 1894.

The President in the chair and 16 persons present.

The minutes of the meeting of October 31st were read and approved.

Mr. Henry Ogden, Treasurer, reported that he had received the legacy of $500 less $25, collateral inheritance tax, bequeathed to the Club by the late Isaac Buchanan, and recommended that it be permanently invested. The matter was referred to the Finance Committee with the request that they report on methods of investment at the next meeting.

The committee appointed to draft resolutions relative to the death of Mrs. Maria L. Daly submitted the following, which were approved and ordered printed in the BULLETIN.

Resolved, That by the death of Mrs. Maria Lydig Daly the Torrey Club has lost one of its most valuable members and sympathetic workers. Though Mrs. Daly, since her connection with the Club, was not often able to attend the meetings, yet she took a keen interest in its proceedings, made herself acquainted with many of its members and associated herself prominently with one of its dearest objects, the founding of the Botanic Garden, which the Club has long been working to establish. When the original efforts for that object were languishing it was largely through the stimulus of Mrs. Daly's zeal and social influence, supported by the hearty coöperation of her husband, Ex-Chief Justice Daly, that the revival of a more extended interest in the enterprise was accomplished; and that, through the opportunities for consultation and friendly intercourse at her home, a direction was given to the movement by which the present organization and promise of success have been reached. She always took great interest in the meetings of all the Garden Committees, and she was herself Chairman of the Ladies' Committee, whose first meeting was held at her house.

She was born on that part of Bronx Park known as the Lydig Estate. She was deeply interested in the plans of the committee who selected that site for the Botanic Garden, and was largely influential in furthering their aims. Mrs. Daly was passionately fond of flowers. In her city home she had them always about her, while in her country place on Long Island she cultivated many of the old favorities, and mourned that fashions in flowers,

as well as in other beautiful things, should make it difficult to secure some of the old-fashioned kinds.

Her frequent association with eminent travelers, the guests of her husband, the eminent President of The Geographical Society, broadened her knowledge and her interest in beautiful plants from all parts of the world. Personally, Mrs. Daly was distinguished by great natural dignity and impressiveness of character; by great charm of manner, broad-minded and intelligent culture, and by open-handed hospitality; and many will miss her warm and loyal friendship.

In her death, the members of the Torrey Botanical Club have lost a loved friend and associate; and the Ladies' Committee, a most valuable Chairman and leader.

Resolved, That we tender to her husband, the Hon. Charles P. Daly, this expression of our appreciation and sympathy and sorrow; and that a copy of these resolutions be presented to him, and be embodied in the proceedings of the Club.

Signed: ANNA MURRAY VAIL,
LENA POTTER COWDIN,
ADDISON BROWN,
Committee.

The following papers were presented:

"On two Species of *Oxalis*," by Mr. John K. Small (published in the November BULLETIN).

"Family Nomenclature," by Mr. John Hendley Barnhart (to be published in the January BULLETIN).

"Note on *Chara sejuncta*." "Japanese Characeae—I.," by Dr. T. F. Allen (published in this issue of the BULLETIN).

Dr. Rusby reported informally that the Trustees of the College of Pharmacy had granted the request of the Club to allow its herbarium to be deposited in their new building.

Dr. Rusby exhibited a specimen of *Azalea nudiflora*, collected in flower at Ulsterville, Ulster county, on November 2d. A general discussion of the phenomena of the second blooming of hardy trees and shrubs followed, during which it was brought out that they are mainly produced by the premature expansion of buds which under ordinary conditions would develop the following spring. *Hamamelis Virginiana* was cited as seemingly the latest blooming shrub of our Flora, while in reality it is the earliest.

TUESDAY EVENING, NOVEMBER 27TH, 1894.

Dr. Britton in the chair.

Mr. L. S. Livingston, 22 East 16th Street, New York City, was elected an active member.

The Finance Committee reported in favor of investing the Buchanan bequest in a savings bank. Upon motion it was unanimously resolved that the report be accepted and approved and that the Treasurer be empowered to make such investment in a savings bank of his selection.

The announced papers of the evening were then read:

1. By Dr. Emily L. Gregory, "Notes on Plant Physiology in German Laboratories."

2. By Dr. Albert Schneider, "Notes on some Lichens of Eastern North America." In connection with the latter paper Dr. Schneider offered some interesting suggestions, based upon his own observations, concerning "Accidental Symbiosis" and concerning the development of chlorophyll bodies.

Dr. Britton exhibited specimens of *Chenopodium album* L. and *C. viride* L., commenting on the general distribution of the former westward and of the latter in the east, and calling attention to the difference in the time of flowering of the two species when they grow together. He requested that observations be made and notes communicated bearing upon the specific distinctness of the two forms. Discussing this paper Dr. Rusby called attention to the close similarity between *C. album* and *C. Quinoa* when found growing wild together in the Andean region.

Reviews.

*Contributions to Lichenology.**—Part I. of Reinke's contributions treats of the podetium of *Cladonia*. It is essentially a criticism of Krabbe's monograph of *Cladonia*. Krabbe maintains that the podetium is the fruit (Frucht) of *Cladonia*, whether it be sterile or fertile. Reinke takes objection to this view, maintaining that all podetia are functially thalloid, hence assimilative and not reproductive. They are considered to be peculiarly modified portions of

* Abhandlungen uber Flechten von J. Reinke in Kiel. Pringsheim Jahrbücher. Heft 3, 1894.

the thallus or adventitious branches developing endogenously from the "gonidial" (algal) layer of the thallus. They possess a gonidial zone which enables them to function as the thallus proper; indeed in some *Cladonia* species the thallus is rudimentary or wholly wanting, in which case the assimilating function devolves wholly upon the podetia. Sometimes they continue to grow for centuries without bearing apothecia or pycnidia, sometimes they bear both and in addition soredia. In fact, they develop, grow and function as the thallus proper.

In Part II. Reinke discusses the position of lichens in the vegetable kingdom. The author places lichens as an independent branch of the plant kingdom, having a special phylogeny. His idea is essentially as follows: In the beginning lichens originated through the association of a fungus and an alga in which the fungus played the part of a true parasite, hence the symbiosis was not yet mutualistic. Through natural selection or some other factor the symbionts developed into a morphological unit, for example, *Collema* thallus. Out of this first lichen (*Collema*) other species have branched off. Lichens belong neither to the algæ nor to fungi. The author considers a lichen as perfect a morphological unit as a tree. He suggests that it may be possible to separate the green and colorless portions of higher plants. (The writer would here state that theoretically chloroplastids of phanerogams must be looked upon as much modified algæ, or at least as chlorophyll bearing and CO_2 assimilating living units.) The true reproductive organs of the lichen are the soredia, since they alone possess the structures capable of producing a new lichen. The spores cannot develop a new lichen until they can develop with the essential alga. Hyphæ and gonidia (algæ) have the same relation to each other as the green and colorless cells in *Riccia* and *Marchantia*. Therefore, lichens should not be placed subordinate to fungi, as is almost universally done now.

In conclusion, the writer would express it as his opinion that most modern lichenologists agree with the author as to the lichen nature. The lichen structure is certainly more or less of a morphological unit. In the ages to come the lichens may be placed as a separate class. By that time they may have become more decidedly individualized as units. Our present knowlege of their

morphology certainly makes it most convenient to arrange them under fungi as ascolichenes and basidiolichenes rather than a separate class. ALBERT SCHNEIDER.

Flora of Nebraska.—Edited by members of the Botanical Seminar of the University of Nebraska. Introduction and Part 1, Protophyta-Phycophyta; Part 2, Coleochaetaceae, Characeae (4to, pp. 128, *pl. 36.* Lincoln, Nebraska, published by the Seminar, 1894).

The beautiful work here noticed must long hold first place in the published results of the exploration and study of a local flora. It is hard to find words in which to express our gratification at its appearance, and we have tried in vain to find any point which is fairly open to adverse criticism. Beginning with a synopsis of the larger groups, including families, and an introduction contributed by Professor Bessey, in the details of which there is room for much difference of opinion, there follow concise descriptions of the classes, orders, families, genera, species and varieties of Protophyta and Phycophyta found within the State, contributed by Mr. DeAlton Saunders, and of the Coleochaetaceae and Characeae by Mr. Albert F. Woods. The descriptions are well drawn, the typography excellent and the plates accurate and well executed. We tender our cordial congratulations to all concerned in the production of the book and to all who may have opportunity to use it. N. L. B.

Ueber neue fossile Pflanzenreste vom Cerro de Potosi. H. Engelhardt. (Abh. Isis, Jahrg. 1894, 3–13. *pl. 1.*)

This is the third contribution published on the flora of the volcanic ash deposits of Cerro de Potosi, Bolivia. The author of the present paper first gave an account of the plant remains, with descriptions of six new species, in Abh. Isis, Jahrg. 1887, 36, 38, *pl. 1.* Some years later further collections were made which were examined by Dr. N. L. Britton, who published the results of his examination in Trans. Am. Inst. Min. Eng. **21**: 250–259, with descriptions and figures of ten more new species. The present paper adds thirty-five to those already published, and it is of interest to note that they have nearly all been referred to genera which now inhabit the region and to species evidently closely allied if not identical with living ones. A. H.

Index to recent Literature relating to American Botany.*

Arthur, J. C. Wild or Prickly Lettuce. Bull. Ind. Exp. Sta. 52: 83–114. *pl. 4.* N. 1894.

Lactuca scariola L. is a serious weed of recent introduction and a well-marked compass plant.

Atkinson, G. F. *Completoria complens* Lohde. Bot. Gaz. 19: 467, 468. 16 N. 1894.

Found parasitic in fern prothallia.

Bailey, L. H. Peach Yellows. Bull. N. Y. (Cornell) Exp. Sta. 75: 390–408. *f. 8.* O. 1894.

Bastin, E. S. Structure of *Asarum Canadense* L. Am. Journ. Pharm. 66: 574–580. *figs.* D. 1894.

Beal, W. J. *Puccinia malvacearum.* Bot. Gaz. 19: 468. 16 N. 1894.

Notes the introduction of this fungus into Michigan.

Bergen, F. D. Popular American Plant-names—III. Bot. Gaz. 19: 429–444. 16 N. 1894.

Buchenau, F. Die Verbreitung von *Oryza clandestina* Al. Braun. Bot. Zeit. 52: 201–206. 16 N. 1894.

Coulter, J. M. and **Rose, J. N.** New Genus of Umbelliferæ. Bot. Gaz. 19: 466. *pl. 32.* 16 N. 1894.

Myrrhidendron from Costa Rica with one species *M. Donnell-Smithii.*

Davidson, A. Californian Field Notes.—V. Erythea, 2: 177–180. 1 N. 1894.

Notes on the Cruciferæ of Los Angeles Co. *Tropidocarpum dubium* n. sp.

Eaton, D. C. A List of Genera of Mosses, revised from Dr. Sauerbeck's list in the Supplement of Jaeger & Sauerbeck's Adumbratio Muscorum. 4to pp. 16. Blue print. Cambridge. Au. 1894.

Eby, A. F. A List of Lichens and a partial List of Fungi collected in Lancaster Co., Pa. Pamphlet, pp. 13. 22 O. 1894.

Fairchild, D. G. Experiments with Fungicides to prevent Leaf-blight of Nursery Stock. Journ. Mycol. 7: 338–353. 15 Au. 1894.

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* This record is compiled by the Editors with the coöperation of Prof. L. M. Underwood, Mr. F. V. Coville and Prof. Conway MacMillan. It is earnestly requested that omissions be communicated to any of the Editors. The titles are reprinted on library cards by the Cambridge Botanical Supply Co., thus making it possible for any one to receive the complete record, beginning January, 1894, alphabetically arranged.

Foerste, A. F. Notes on Dedoublement. Bot. Gaz. **19**: 460–465. *figs.* 16 N. 1894.

Notes on *Trillium sessile*, *Ulmus*, *Arisæma triphyllum* and *Podophyllum peltatum*.

Ganong, W. F. Beiträge zur Kenntniss der Morphologie und Biologie der Cacteen. Flora, 1894. [Reprint, pp. 40. Munich. 1894.]

Greene, E. L. Observations on the Compositæ.—VI. VII. Erythea, **2**: 89–96. Je. 105–112. Jy. 1894.

Hildebrand, F. Ueber die Heterostylie und Bastardirungen bei *Forsythia*. Bot. Zeit. **52**: 191–200. *pl. 6.* 16 N. 1894.

Hooker, J. D. *Sesbania exasperata*. Curt. Bot. Mag. **50**: *t. 7384.* N. 1894,

A tropical American species.

Jack, J. G. *Æsculus parviflora*. Gard. & For. **7**: 444. *f. 70.* 7 N. 1894.

Jenman, G. S. *Adiantum dissimulatum*. Gardn. Chron. **16**: 656. 1 D. 1894.

A new species from Jamaica.

Jenman, G. S. *Trichomanes* (*Didymoglossa*) *solitarium* n. sp. Gardn. Chron. **16**: 592. 17 N. 1894.

A new species from Jamaica.

Kearney, T. H., Jr. *Steironema intermedium* Kearney. Bull. Torr. Bot. Club, **21**: 460. 24 O. 1894.

Kennedy, G. G. *Lemna Valdiviana* in Massachusetts. Bot. Gaz. **19**: 468. 16 N. 1894.

Knowlton, F. H. A new fossil Hepatic from the Lower Yellowstone in Montana. Bull. Torr. Bot. Club, **21**: 458–460. *pl. 219.* 24 O. 1894.

Preissites Wardii, new genus and species.

Kerr, J. G. Botany of the Pilcomayo Expedition, being a List of Plants collected during the Argentine Expedition of 1890–91 to the Rio Pilcomayo. Trans. Bot. Soc. Edinb. **20**: 44–78. 1894.

La Mance, L. S. The Walking Fern and its Haunts. Gard. & For. **7**: 488. 5 D. 1894.

A note on *Camptosorus rhizophyllus* in Missouri.

Lloyd, F. E. The Garry Oak. Gard. & For. **7**: 494. 12 D. 1894.

Describing *Quercus Garryana* in Oregon.

Lemmon, J. G. Notes on West American Coniferæ.—V.–VI. Erythea **2**: 157–162. 1 O. 173–177. 1 N. 1894.

Discusses the Mendocino pines, *Pinus muricata* and *P. Bolanderi*, and describes two varieties of *P. contorta*.

Meehan, T. *Aspidium Thelypteris.* Meehans' Month. **4**: 177. *pl. 12.* D. 1894.

Meehan, T. *Gentiana crinita.* Meehan's Month. **4**: *pl. 11.* N. 1894.

Meehan, T. *Osmunda Claytoniana.* Meehans' Month. **4**: 145. *pl. 10.* O. 1894.

Mohr, C. Die Wälder des südlichen Alabamas. Pharm. Rund. **12**: 211–213. S. 1894.

Morong, T. The Smilaceæ of North and Central America. Bull. Torr. Bot. Club, **21**: 419–443. 24 O. 1894. (Posthumous.)

Descriptions of all the species. *Smilax Smallii* and *S. megacarpa* are new species from the Southern United States and *S. Panamensis* from the Isthmus of Panama.

Nelson, A. Squirrel-Tail Grass. Bull. Wyoming Exp. Sta. **19**: 70–84. *pl. 4.* S. 1894.

Hordeum jubatum L. The awns seriously injure the jawbones and frequently cause blindness in live stock.

Olver, D. *Pilocarpus microphyllus.* Hook. Icon. Pl. **24**: *pl. 2331.* 1894.

A Brazilian species.

Pierce, N. B. Prune Rust. Journ. Mycol. **7**: 354–363. *pl. 34–37.* 15 Au. 1894.

Rose, J. N. Some Notes on Tree *Ipomœas* of Mexico. Gard. & For. **7**: 366. *f. 58, 59.* 12 S. 1894.

Notes on *Ipomœa fistulosa, I. muricoides,* and descriptions of two new species, *I. intrapilosa* and *I. Wolcottiana.*

Rothrock, J. T. River Birch. Forest Leaves, **4**: 185. D. 1894.

Two illustrations of *Betula nigra* L.

Sargent, C. S. The Wax-Myrtles of the Sea-coast of Eastern North America. Gard. & For. **7**: 474. 28 N. 1894.

Figures are given of *Myrica cerifera* and *M. Carolinensis.*

Sargent, F. L. Pollination of Orchids. Pop. Sci. News, **28**: 85, 86. *f. 1–6.* Je. 102, 103. *f. 7–11.* Jy. 1894.

Schaffner, J. H. The Nature and Distribution of Attraction-spheres and Centrosomes in Vegetable Cells. Bot. Gaz. **19**: 445–459. *pl. 33.* 16 N. 1894.

Smith, E. F. Field Notes, 1892. Journ. Mycol. 373–377. *pl. 38.* 15 Au. 1894.

Notes on various diseases of cultivated plants. The plate illustrates the crown gall of Lombardy poplar and peach.

Waite, M. B. Treatment of Pear Leaf-blight in the Orchards. Journ. Mycol. 7: 333–338. *pl. 32, 33.* 15 Au. 1894.

Webber, H. J. Preliminary Notice of a fungous Parasite on *Aleyrodes Citri* R. & H. Journ. Mycol. 7: 363, 364. 15 Au. 1894.

White, T. G. A preliminary Revision of the genus *Lathyrus* in North and Central America. Bull. Torr. Bot. Club, **21**: 444–458. 24 O. 1894.

Analytical key to the species with synonymy; describes four new species. *L coriaceus, longipes, Oregonensis* and *bijugatus;* also several new varieties.

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

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AND OTHER MEMBERS OF THE CLUB.

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